Bellwork: 11/2

$$\left(-\frac{1}{3}x+1\right)=\left(\frac{3}{2}x-1\right)$$

$$-2x+6=9x-6$$

$$-6 \quad -6$$

$$-2x=9x-12$$

$$-9x \quad -9x$$

$$-11x=-12$$

$$\frac{-11x}{-11}=\frac{-12}{-11}$$

$$x=\frac{12}{11}$$

$f(x)=2x$; $g(x)=x^2+2$

$g(f(x))=$

$g(2x)$

$(2x)^2+2$

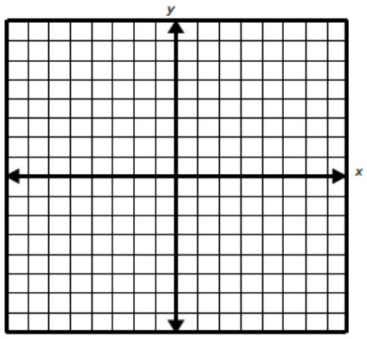
$4x^2+2$

Given the function: $f(x) = x + 3$

1.) Create an x/y chart:

x	1	2	3	4	5	6
y						

2.) Graph $f(x) = x + 3$



If we **interchange** the **x** and **y** coordinates, we form an **inverse function** of f. The notation used to denote the inverse is _____

Create an x/y chart for the $f^{-1}(x)$ and graph above. What can you conclude?

x	4	5	6	7	8	9
y						

Note: Inverse functions "undo" each other.

*The domain of $f(x)$ is the range of $f^{-1}(x)$ and vice versa.

Inverse of a Relation

- The inverse of a relation consisting of the ordered pairs (x, y) is the set of all ordered pairs (y, x)
- The domain of the inverse is the range of the original relation
- The range of the inverse is the domain of the original relation

$f(x)$ $f^{-1}(x)$

D: D:
R: R:

Example 1: Find the inverse of each relation. State whether the relation is a function. State whether the inverse is a function.

a.) {(1, 2), (2, 4), (3, 6), (4, 8)} yes function

Inverse: {(2, 1) (4, 2) (6, 3) (8, 4)}

b.) {(1, 5), (1, 6), (3, 6), (4, 9)} No yes function

Inverse: {(5, 1) (6, 1) (6, 3) (9, 4)}? No

{(1, 3) (2, 3) (3, 5)} yes

{(3, 1) (3, 2) (5, 3)} no

To find the inverse of a function:

1.) Replace $f(x)$ notation with y
2.) Rewrite function by interchanging x and y
3.) Solve for y
4.) Replace y with $f^{-1}(x)$

Example 2: $f(x)=\frac{5-3x}{2}$

$\frac{2x-5}{-3} = f^{-1}(x)$

To find the inverse of a function:

1.) Replace $f(x)$ notation with y
2.) Rewrite function by interchanging x and y
3.) Solve for y
4.) Replace y with $f^{-1}(x)$

Example 3: $f(x) = \frac{4-x}{6}$

$y = \frac{4-x}{6}$

$6 \cdot x = \left(\frac{4-y}{6}\right)6$

$6x = 4 - y$

$6x - 4 = -y$

$\frac{6x-4}{-1} = y$

$f^{-1}(x) = \frac{6x-4}{-1}$

$f^{-1}(x) = -6x + 4$

To find the inverse of a function:

1.) Replace $f(x)$ notation with y
2.) Rewrite function by interchanging x and y
3.) Solve for y
4.) Replace y with $f^{-1}(x)$

Example 4: $f(x) = 10x - 5$

$$\frac{x+5}{10} = f^{-1}(x)$$

Verifying That Functions are Inverses

Two functions are inverses if:

$f \circ f^{-1}(x) = x$ **and** $f^{-1} \circ f(x) = x$

Determine whether the following functions are inverses using composition.

4.) $f(x) = 4x + 1$ $\qquad$ $g(x) = \dfrac{x-1}{4}$

Verifying That Functions are Inverses

Two functions are inverses if:

$f \circ f^{-1}(x) = x$ **and** $f^{-1} \circ f(x) = x$

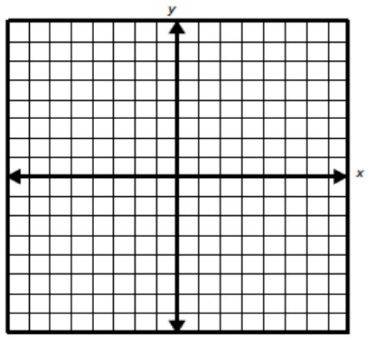
5.) $f(x) = x - 3$ $\qquad$ $g(x) = -x + 3$

Determining if the inverse of a function is a function from a graph:

Horizontal-Line Test

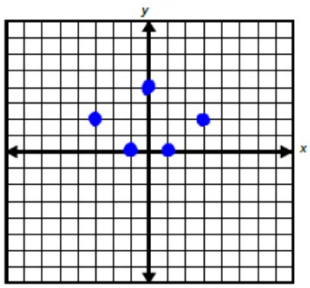
- The inverse of a function is a function if and only if every horizontal line intersects the graph of the given function at no more than one point.

Example 5: Graph f(x) = 3x – 2. Determine whether its inverse is a function. Then find the inverse and graph it to verify.



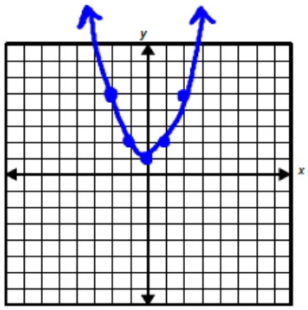
If a function has an inverse that is also a function, then the function is a **one-to-one function**. Therefore, every 1-1 function passes the horizontal-line test.

Is the relation a function? Find the domain and range. Graph the inverse of each relation and determine whether the inverse if a function. Then find the domain and range of the inverse.



Original:
F? _____
D: _____
R: _____

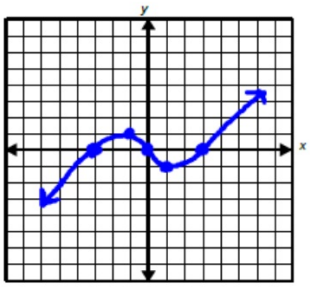
Inverse:
F? _____
D: _____
R: _____



Original:
F? _____
D: _____
R: _____

Inverse:
F? _____
D: _____
R: _____

Is the relation a function? Find the domain and range. Graph the inverse of each relation and determine whether the inverse if a function. Then find the domain and range of the inverse.



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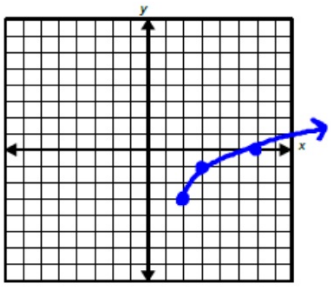
D: _____
R: _____

Inverse:
F? _____
D: _____
R: _____



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Inverse:
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